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COUNTRY AND INTERCOUNTRY PROGRAMMES AND PROJECTS

PROJECT RECOMMENDATION OF THE ADMINISTRATOR

Assistance for a global project

International Centre of Insect Physiology and Ecology - Development of Long-range Means of Control of Crop and Livestock Pests and Diseases (GLO/81/004)

Estimated UNDP contribution:	$7 925 000
Duration:	Five years
Executing Agency:	UNDP

I. Background

1. The International Centre of Insect Physiology and Ecology (ICIPE) was established in Nairobi, Kenya, in 1970, at the initiative of a group of eminent entomological scientists, to provide a resource base for fundamental studies on the physiology and ecology of insects of world-wide economic importance. ICIPE fulfils two major functions: (a) it is creating an institution unique in its cultural, educational and scientific aspects, where a diversity of scientific talent from developing and developed countries can pursue advanced research under the guidance

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of eminent scientists, making maximum use of the natural and human resources of developing countries: (b) the knowledge and experiences of ICIPE will provide basic knowledge of the biology of several groups of pests important in many developing countries. Such knowledge is essential to permit these countries to develop practical integrated pest control systems which will minimize the economic damage of insecticide residues on human populations and their environment.

2. Since 1972, UNDP has been assisting ICIPE in its research and training programmes. In January 1973, the Governing Council of UNDP approved a five-year project for this purpose with an earmarking of $3,164,900.1/ In January 1977, the Governing Council approved additional financial assistance for a second phase of operations over a further five-year period at a cost of $4,529,000.2/ Subsequently in January 1978, the Governing Council approved a supplementary allocation of $260,000 to be used towards the construction of a training hostel at ICIPE.3/ The objective of the UNDP project at ICIPE is two-fold: (a) to carry out basic and applied research on critical aspects of insect physiology and ecology required for the development of environmentally sound and effective biological pest control systems, as an alternative to often harmful chemical insecticides; and (b) to train developing country scientists and technicians in the afore-mentioned disciplines.

3. The research under the UNDP project is concentrated on the following major pests that affect crop and livestock and in some cases human beings: tsetse flies; African armyworms; mosquitoes; ticks; foraging termites; sorghum shoot flies; cereal stem borers; and grain legume pod borers. From the foregoing description, it is evident that the work of ICIPE, which is being financed by UNDP, supplemented by contributions from a group of other donors, transcends the boundaries of research on human, animal and plant pests and diseases. In the last eight years, ICIPE has grown into a first-class scientific research institution, internationally recognized and respected. While many of the pests and diseases problems have been the object of practical eradication and/or control measures by various national, regional and international organizations for several decades, no simple methods of control are available. Therefore, ICIPE has had to adopt a different strategy to what appear to be intractable pest problems. First, it has brought together, within a single intellectual and scientific environment, a multiplicity of disciplines and specializations (many of which were not traditionally associated with entomological research) - plant host-insect relations, sensory physiology, chemical communication pheromonal physiology, epidemiology, insect immune mechanisms, basis of plant resistance to insect attack, insect population modelling, insect pathology, as well as the more traditional entomological studies - all concentrating on the target species, in an attempt to make breakthroughs which would lead to novel pest management technologies without the already known drawbacks of chemical approaches to insect control. Second, it has adopted an open strategy for each of the target insects: in each case, ICIPE is exploring lines of study which hold promise as new avenues for pest management. Third, while not neglecting short-term tactics for pest control, it has not felt it compelling to devote most of its resources to fire-fighting efforts which might result in short-term control of pest outbreaks.

1/ DP/PROJECTS/R.2/Add.4.
2/ DP/PROJECTS/R.17/Add.1.
3/ DP/PROJECTS/R.9/Add.6.

4. Important discoveries have been made by ICIPE in the last eight years, and these relate to: the reproductive physiology, isolation mechanisms, sensory physiology and genetic variability of the various insects involved and ecological influences on their behaviour; development of non-chemical control of pests and diseases, giving special attention to the small, resource-poor farmers; and investigations into the use of naturally occurring substances as pesticides. These discoveries are indeed of vital strategic importance for the development of biological methods of control, not only of pests which threaten food crop production, but also of those insects which are major vectors of tropical diseases in developing countries. As an integral part of the UNDP project, large numbers of developing and developed country specialists are being trained at ICIPE in all of the afore-mentioned fields. Illustrative examples of ICIPE's discoveries of considerable practical significance to agriculture are: (a) livestock ticks research which can provide data relevant to a practical integrated solution to tick-borne diseases of livestock; (b) crop borer and sorghum shoot fly research integrated with plant resistance to insect attack which demonstrates that sorghum plants taller than 20 centimetres are not attacked by sorghum shoot flies, a devastating pest; (c) results emerging from research on armyworm, medical vectors, tsetse flies and termites, which are providing important leads of practical significance.

5. The ICIPE research programmes are closely linked with the work of such international centres as the International Laboratory for Research on Animal Diseases (ILRAD), the International Institute of Tropical Agriculture (IITA), the International Rice Research Institute (IRRI), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Maize and Wheat Improvement Centre (CIMMYT), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization's (WHO) Tropical Diseases Research Programme, the West African Rice Development Authority (WARDA) and a number of national institutions in both developing and developed countries.

6. While the UNDP project has made steady progress and is receiving enthusiastic moral and financial support from UNDP, the Government of Kenya and a group of outside donors, it is evident that in view of the long-term nature of the investigations presently under way, some of which will require sustained support before payoffs can be expected, a long-term commitment of financial support to ICIPE is needed from all concerned external donors. In view of the fact that the current UNDP project at ICIPE is scheduled for completion in December 1981, ICIPE has approached UNDP for follow-up assistance for a further five-year period.

7. The results and accomplishments of ICIPE were critically evaluated in December 1980 by a UNDP commissioned consultant mission consisting of two prominent scientists. This mission, in speaking very favourably of the progress of the UNDP project at ICIPE as a whole, strongly recommended the continuation of UNDP assistance for a further five-year period to consolidate current work and to expand and intensify research and training in key areas which have shown promise. The UNDP Administrator's advisory panel on the global programme, at its first meeting held in January 1981, endorsed further UNDP support to ICIPE and observed that the work of ICIPE would be an extremely important input in the development of pest management policies and techniques. Realizing the importance of ICIPE research activities to the solution of pest management problems of tropical countries of the developing world, a number of bilateral and multilateral donors have been providing financial support which is

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steadily broadening. UNDP support to ICIPE during 1972-1977 amounted to approximately 60 per cent of the total resources made available by all donors, and this proportion has now decreased to 20 per cent. Thus, UNDP has been instrumental in marshalling financial assistance to ICIPE from a number of donors. In order to assure continuity of the magnitude of financial support needed over the next several years, arrangements are presently under way to establish a consortium of interested bilateral and multilateral donors in order to secure a more stable and long-term financial support for ICIPE. The World Bank has agreed to provide secretariat services for the consortium and to act as its fiscal agent.

II. The Project

8. The general objectives of the project are to:

(a) Continue to seek new knowledge that will lead to the development of long-range, effective and environmentally-acceptable pest management techniques;

(b) Continue to collaborate closely with the international agricultural research centres, and to strengthen the co-operative linkages of ICIPE with the national programmes in tropical countries and applied research institutions, in order that ICIPE research results can be incorporated effectively into experimental and pilot schemes for pest control; and

(c) Assist in building up the human resources in the field of pest management research and practice in Africa and other tropical regions by its programme of training and study workshops.

9. Project activities will be concerned primarily with research into crop pests, and also with research support services and training. Specific topics of research are as follows:

A. Bases of plant resistance to insect attack

10. The use of insect resistant food crops will be a key component of a comprehensive crop pest management programme, which will be implemented in close collaboration with international agricultural research centres such as IRRI, ICRISAT, IITA and CIMMYT. Major lines of investigation will include: field screening of breeding materials of crops at the ICIPE field station at Mbita Point to determine the resistance of specific crops to target insect pests; studies on physical and chemical factors affecting plant resistance, including the isolation and identification of the chemical compounds involved; genetic studies on the inheritance of resistance in order to understand genetic factors controlling resistance to insects; and genetic and physiological mechanisms responsible for the breakdown of resistance in plants when new insect biotypes are formed. Current work involving the above investigations on stem borers of maize, sorghum and cowpeas, which are major food resources in Africa, will be intensifed in an effort to obtain quick results to benefit subsistence farmers. Studies on the rice brown plant hopper, which would have application primarily to Asia, will be continued in collaboration with IRRI.

B. Investigations on crop borers

11. These studies will focus on four target species of insects which attack cowpea, maize, sorghum, millet and rice, causing considerable crop losses. The sorghum shoot fly, for example, can destroy 80 per cent of the crop. Investigations will include: assessment of crop losses, study of the biology, ecology and behaviour of the pests, crop/pest relations, seasonality, offseason survival, etc.: identification of weak links in the life-cycles and biology of the pests; insect/host interactions under intercropping systems; and identification of natural disease organisms (insect pathogens) and parasites and predators of the target pests.

12. The above research, which will be conducted in close co-operation with IITA, ICRISAT, IRRI, WARDA, CIMMYT and the FAO Regional Programme in Kenya, is expected to result in technology to minimize damage due to the pests concerned and to develop capabilities of national personnel of African countries and other tropical countries in the relevant control techniques. Since the crops mentioned above provide more than 50 per cent of the food energy of the subsistence farmers, pest management strategies to control the crop borers affecting these crops would be of great economic significance.

C. Research on African armyworm

13. The African armyworm is a major pest in countries of eastern and southern Africa and in the Yemen region of the Arabian Peninsula. It mainly attacks grasses but also cereal crops such as maize and sorghum. The devastation it causes is primarily due to its unpredictable appearance and the rapid development of outbreaks. Other damaging armyworm species are known to occur in other parts of the tropics. In the last seven years, ICIPE has conducted basic research on the biology, feeding, mating and reproduction of the armyworm. This work has been carried out in close co-operation with the monitoring and forecasting of armyworm migrations undertaken by the Desert Locust Control Organization for East Africa, the Kenya Agricultural Research Institute (KARI) and the Centre for Overseas Pest Research of the United Kingdom. Further research on armyworm at ICIPE will include the following topics: survival of armyworms during adverse seasons; behaviour of gregarious and solitary phase caterpillars in the field and laboratory; marking techniques for tracing movement of armyworm moths; and ecology of the virus disease of armyworm caterpillars, which can be a key mortality factor.

14. The above programme, which has suffered from inadequate resources, will be revitalized in the present project in order to apply practical results as widely as possible.

D. Work on grassland termites

15. In the past five years, ICIPE has demonstrated that grassland termites can forage as much plant material as livestock and game animals put together. This finding has major implications for the management of the fragile pastures in the semi-arid areas of tropical Africa. It has also been found that termites play an important role in soil development and in recycling soil organic matter, thereby improving the soil structure and soil fertility. Further work on termites will be concentrated on the quantitative assessment of their role in the above-mentioned areas and on devising means to control harmful termites under stressful environmental

conditions, while encouraging beneficial ones. Specific research will be conducted on: (a) nitrogen utilization, the nutritional significance of fungus culturing by the termites, ecological preferences and competition, predation and pathology; and (b) colony structure and composition, amounts of food consumption, biomass, mound density and area, mound ages, laboratory techniques on the physiology of caste differentiation and trail-laying behaviour, which is controlled by chemicals called pheromones in the termites.

E. Livestock ticks research

16. A large number of tick species feeds on domestic livestock (cattle, sheep, goats, donkeys, etc.), causing anaemia and the transmission of a variety of harmful and debilitating diseases to human beings. Most of these diseases occur in Africa and are not very amenable to chemotherapy. Present methods of tick control which involve dipping the animals in pesticide solutions are unsatifactory because of their toxicity, the chance of inducing pesticide resistance in the ticks, the high cost and the chance that the solutions will leave dangerous residues in animal products. Future lines of ICIPE research on ticks will include: the immune response of host animals, to determine differences in resistance to ticks; introduction of resistance to ticks in cattle through the development of suitable antigens; and the physiology and ecology of ticks, to facilitate the possible development of an integrated, environmentally sound methodology for the control of ticks and tick-borne diseases.

17. The above research programme will be carried out in close co-operation with ILRAD and KARI.

F. Tsetse research

18. Trypanosomiasis is one of the major parasitic diseases in Africa south of the Sahara. It affects human beings, causing sleeping sickness; in animals, the disease is called Nagana. The disease, which is transmitted by tsetse flies, causes poor performance and death. Tsetse fly and trypanosomiasis research at ICIPE is aimed at studying the important phases of the life cycle of the fly, as well as the phases of development of the trypanosome parasites within the fly and mammalian hosts. The research studies the interrelations of three components, namely: vertebrate hosts, invertebrate vectors and trypanosomes. The aim is to find a new and effective measure to disrupt the transmission of the disease and to help in the planning of co-ordinated control strategies. The programme involves a number of specialized disciplines and consists of three research projects: tsetse reproductive physiology; tsetse ecology and trypanosomiasis epidemiology; and trypanosome vectors physiology. Research activities are performed at ICIPE headquarters in Nairobi and in the field. The support units interact with the programme by providing significant inputs into fundamental studies related to tsetse physiology and to the biology of the trypanosomes. Co-operation is presently going on with the former East African Trypanosomiasis Research Organization in Tororo, Uganda, the recently established Kenya Trypanosomiasis Research Institute, the Tsetse Research Laboratory in the United Kingdom and with IAEA, FAO, WHO and ILRAD. The mandate of ILRAD is to thoroughly investigate immunology in trypanosomiasis in the hope of developing a vaccine to protect cattle against this disease.

19. The current work of ICIPE in the field as well as in the laboratory on tsetse ecology, epidemiology, reproductive physiology and trypanosome tissue culture immunology has yielded significant results, thereby raising the possibility of control systems. These programmes will be intensified in collaboration with the institutions mentioned above and, in particular, with ILRAD.

G. Medical vectors of tropical diseases

20. Africa and other parts of the tropics are afflicted with several major diseases in human beings. Three of the important diseases are malaria (caused by mosquitoes), bancrofti filariasis (filarial worms which infect human beings and cause blindness or general ill health) and leishmaniasis (referred to a heterogeneous group of diseases ranging from sores on the skin to fatal diseases caused by parasitic organisms which are probably transmitted in the same way as trypanosomes). These diseases have a seriously disabling and sometimes mortal effect on human beings. ICIPE research on these diseases includes studies in: ecology, population dynamics, physiology, vector behaviour, insect-parasite relationships and the identification of reservoir animals. Pathogens and parasites affecting the disease organisms are being studied to develop environmentally acceptable methods of control. These studies will be continued with appropriate shift in emphasis and implemented in close collaboration with the WHO/UNDP Special Programme on Tropical Diseases Research and Training, research institutions in France, the Ministry of Health of Kenya and the Medical Faculty of the University of Nairobi.

21. The various programmes described above are integral elements in the overall research programme of ICIPE. Parts of specific components are financed by other donors. In the case of each of the above-mentioned activities, the assistance requested from UNDP is meant for the basic support required to enable ongoing research to be continued and broadened. Supplementary assistance is anticipated from other sources.

Research Support Services

22. ICIPE currently operates four support research units for chemistry and biochemistry, histology and fine structure, sensory physiology, and bioassay. In addition, the following units have been established: insect and animal breeding; field stations (Mbita Point, Muhaka and Kajiado); outreach management; workshops (electronic, mechanical, woodworking, glass-blowing, etc.); laboratory management; and library and documentation. Some of the laboratories listed above are reasonably well-equipped, with modern scientific apparatus and equipment which are playing a significant role in fundamental and applied research at ICIPE. Items of equipment now requested from UNDP will supplement those already available and will be used to meet specific needs of the research programmes enumerated above. None of the funds requested from UNDP will be used for capital costs.

Training

23. ICIPE has given the highest importance to training at all levels which incorporates scientific, technical and managerial elements. Several schemes are available to achieve the training objectives, with greater opportunities being given to scientists from developing countries. These are: research associateships for gifted young scientists; post-doctoral research fellowships; graduate research

scholarships; science bursar scheme to enable bright high school students to obtain a six-month work experience at ICIPE; professional technical and administrative staff training programmes for ICIPE staff; language training (French, Swahili and English); ICIPE/UNEP training course in integrated pest management; study tours and overseas study leaves; and workshops and seminars. In the last eight years, over 260 man-years of training have been imparted in the afore-mentioned areas. Participants from 55 countries have attended ICIPE workshops. The UNEP/ICIPE training course has been attended by participants from 27 countries. The availability of new and expanded hostel facilities, which were constructed with financial assistance from UNDP, the Special Fund of the Organization of Petroleum Exporting Countries (OPEC) and the United Kingdom, makes it possible for a greatly enlarged training programme to be undertaken by ICIPE. During the next phase of UNDP support, a major expansion of the various training programmes is projected, with wider geographic representation including Asia and Latin America. While the funds requested from UNDP for training will be used largely for specific training programmes, the bulk of the major expansion of training planned during the next 3-4 years will be financed by other donors.

24. A review of all of ICIPE programmes of research and training is made each year at the annual research conference in June when practical and urgent questions of pest control receive the careful attention of scientists. This assessment is made crucial by the participation of the ICIPE consultants, collaborators and scientific representatives of the UNDP and international and African agencies and institutions with particular interest in the work of ICIPE. Additionally, in order to assess and advise ICIPE on its programmes of work, particularly as to the emphasis to be given to research, training and demonstration activities during the project period, each year ICIPE will invite representatives of UNDP, UNEP, the specialized agencies of the United nations family, donor agencies, African scientific institutions and the international research centres to participate in the open meetings of the ICIPE Governing Board and its Programme Committee, as it deems appropriate.

25. Midway in the course of the project, UNDP, in consultation with ICIPE, might decide to schedule an evaluation of project activities to be undertaken by a team of 2-3 independent consultants. Such an evaluation, if needed, could be undertaken in conjunction with an annual ICIPE research conference referred to in paragraph 24. In any event, towards the completion of the project, a thorough evaluation of project results and accomplishments will be mounted by UNDP in consultation with ICIPE, to be carried out by independent and prestigious consultants.

26. The expenditure component of the proposed UNDP contribution is:

	US$
Subcontract	$7,725,000

27. The expenditures under the project will be contained within the Indicative Planning Figure established by the Governing Council for global projects.

III. Recommendation

28. In the light of the above, the Administrator recommends that:

The Governing Council,

(a) Approve this project; and

(b) Authorize the Administrator to make appropriate arrangements with ICIPE for the execution of this project.